DEPARTEMENT TOEGEPASTE ECONOMISCHE WETENSCHAPPEN

ONDERZOEKSRAPPORT NR 9667

Generic Object Models and Business Process (Re)Design

by

G. Dedene

M. Snoeck

Katholieke Universiteit Leuven

Naamsestraat 69, B-3000 Leuven

ONDERZOEKSRAPPORT NR 9667

Generic Object Models and Business Process (Re)Design

by

G. Dedene

M. Snoeck

D/1996/2376/68

Generic Object Models and Business Process (Re)Design

Prof. Dr. G. DEDENE
Dr. M. SNOECK
Katholieke Universiteit Leuven
Faculty of Economics and Applied Economics
L.I.R.I.S.
The Leuven Institute for Research on Information Systems
Naamsestraat 69
B-3000 Leuven
Belgium
telephone: + 32 16 32 67 12
Fax: + 32 16 32 67 32

email: {Guido.Dedene, Monique.Snoeck}@econ.kuleuven.ac.be

ABSTRACT

This paper explores the capabilities of generic object-relationship models in the context of business process modelling and business process re-engineering. The presentation is based on a framework for strategic business function typology. It is shown how generic models can be developed for each kind of business function within the typology. Business process re-engineering can be represented by transformations of business models, corresponding to shifts within the typology framework. Although the results of the paper are presented by means of one particular dialect of the object-relationship approach, the results remain valid for all object oriented approaches that make use of objects and relationships. The paper contributes to the further formalisation of business process modelling.

Keywords : Object Oriented Analysis - Entity-Relationship - Software Development - Business Modelling.- Business Process Reengineering

INTRODUCTION

Business modelling and business process (re-)design are topics that excite the information systems community substantially today. In many cases, business process redesign turns out to be nothing but just a new term for a major change in an organisation. On the other hand, business process modelling creates a platform which enables better interaction between business and IT-professionals.

No generally accepted methodology for business process redesign is available today. Some approaches make use of conventional data-flow-based techniques. The purpose of this paper is to illustrate the potential of object oriented business modelling techniques, and in particular the ones that make use of entity relationship based techniques. This paper will follow the M.E.R.O.DE.-approach [1, 2] to object oriented business modelling. This approach has grown out of research on the integration of the Jackson method with entity relationship models [5]. The results are however by no means restricted to that approach only.

Introducing the notation

An easy way to visualise relationship objects is to view them as classes, existence dependent of the participating object classes. In this way, object relationship models are obtained that only contain binary relationships (one to one or one to many) that are in addition weak on one side [7]. Fig. 1 shows how a loan relationship between a member and a book in a library is turned into a class on its own. It is clear that every loan object is existence dependent of a member and a book. Reversely, a book has at most one existence dependent loan object at one point in time, while a member can have several loans at one point in time. The existence dependency relationship is depicted as an arrow pointing from the strong object class to the existence dependent class and cardinalities are indicated by a black (many) or white (1) dot.

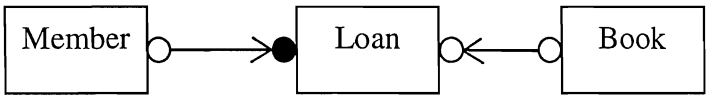

Fig. 1. Object Relationship diagram for a Library

This paper will explore the possibilities of generic object relationship models. First of all, a classification framework for generic business functioning is introduced. Next each quadrant of the classification framework is illustrated with generic models, and some examples of instances of these models. Additional richness is brought into the models by means of typing business objects. In between, examples of business process re-design are discussed in the context of the proposed classification and generic models. It is shown how different types of business process re-engineering are represented by transformations of the corresponding object relationship models, or correspond to shifts within the business function classification framework. Finally some remarks on improved tool support for business modelling by means of object relationship modelling are discussed.

THE SIMON STRATEGIC FUNCTION TYPOLOGY

The strategic function typology of Simon [6] is a first attempt to classify organisations in terms of the strategic links between components of the involved partners in business activities. In accordance with many strategic positioning techniques, this strategic typology uses a grid structure.

On dimension of the grid is the functional direction of the organisation. It distinguished product oriented organisations from capacity oriented ones. Organisations with a capacity demand typically respond to product demands. In most cases these product demands are defined and generated externally. The capacity organisation acts as a channel structure to react to these demands. Organisations with a product function define and provide their own product offerings.

The other dimension of the grid is an organisational control structure classification, which separates market-oriented organisations from task-oriented ones. A market organisation is controlled by the free market, and is free to set up its own relationships with customers in that market. A task organisation is providing the necessary product or capacity function within the control of another organisation, which will be called the controlling organisation. It is clear that the presence or absence of a controlling organisation has a tremendous impact on the dynamics of the company. Fig. 2. gives an overview and illustration of Simon's strategic function typology.

	MARKET ORGANISATION	TASK ORGANISATION
PRODUCT FUNCTION	I Software Vendor	III Certifying Organisation
CAPACITY FUNCTION	II Software House	IV Internal Consulting Staff

Fig. 2. Examples in Simon's Strategic Function typology

In a market organisation, the organisation will want to establish continuous relationships with its customers. Basically, because of the competition within a limited potential of customers, techniques of customer linking and differential positioning in terms of product differentiation or cost efficiency will be used. In the presence of a controlling organisation, much of this dynamics is killed, especially when the controlling organisation is also providing the rewarding for the business activities.

This description makes clear what the building block of generic models are in view of the strategic function typology of Simon. Obviously, Customer is a central object. However, the distinguishing element will be the nature of the business transaction. In this paper, transaction intentions will be separated from effective transactions. Indeed, one measure of business effectiveness is the ratio of effective transactions over transaction intentions (like the order/bid ratio). The following paragraphs will explore generic models for each quadrant of the Simon grid.

I: A MARKET ORGANISATION WITH A PRODUCT FUNCTION

A market organisation provides different kinds, or types of services and/or products. Being a market organisation, a primary activity consists of making customers interested in the product/service types that are offered. This interest is reflected in transaction intentions. An effective business transaction establishes a relationship between a product/service (of some type) and a customer.

Fig. 3 shows a simple model for this strategic function typology.

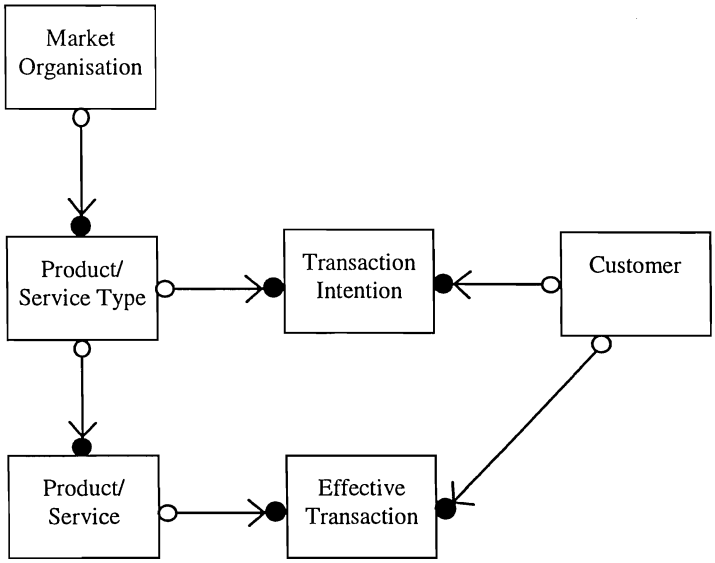

Fig. 3. Simple Model for a Market Organisation with a Product Function

The model can further be enriched by creating explicit relationships between the transaction intentions and the effective transactions. Observe how in that case the direct relationship between customer and effective transaction is no longer needed. On the other hand, without a direct link between transaction intention and effective transaction, more freedom is possible. For example, effective transactions without a matching transaction intention.

By modifying the names of the objects, different concrete business models can be realised. A simplified hotel function is a nice example of a market organisation with a product function (see Fig. 4).

The transaction intention and the effective transaction business objects are the centres of activity in the business model: they generate the activity within a market organisation with a product function.

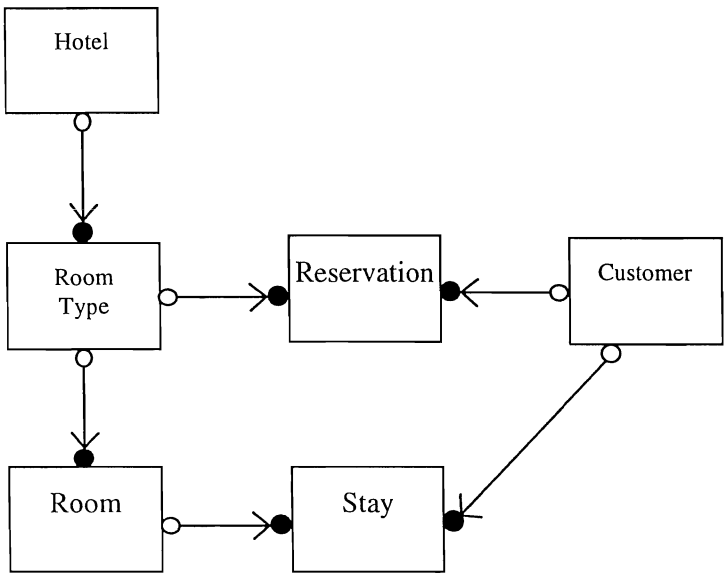

Fig. 4. Simplified Hotel function

II: A MARKET ORGANISATION WITH A CAPACITY FUNCTION

A market organisation with a capacity function acts as a channel between suppliers of types of products and services on one hand, and customers on the other hand. The transaction intention is the most crucial business object, which is dependent on the market organisation itself, a customer, a supplier and a particular type of product/service. Fig. 5 shows a generic model for such an organisation.

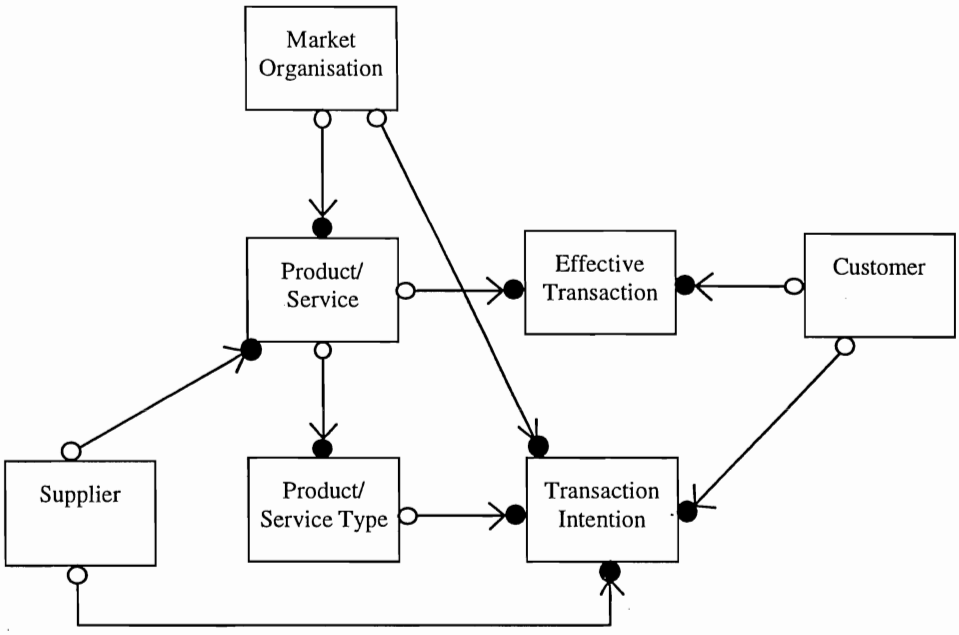

Fig. 5. Market Organisation with Capacity Function

A typical example of a market organisation with a capacity function is a travel agency. A travel agent looks for suppliers of, for example, hotel rooms. In this model, a hotel would be a supplier of hotel rooms or other types of travel related product and services.

MOVING FROM A PRODUCT TOWARDS A CAPACITY FUNCTION: AN EXAMPLE OF PROCESS RE-DESIGN

In a lot of organisations, the operational interventions are handled by means of a hierarchical structure. Fig. 6 might typically be the organisation of a elevator servicing company. Interrupts in the functioning of an elevator are notified to a local office, which sends one of its service engineers.

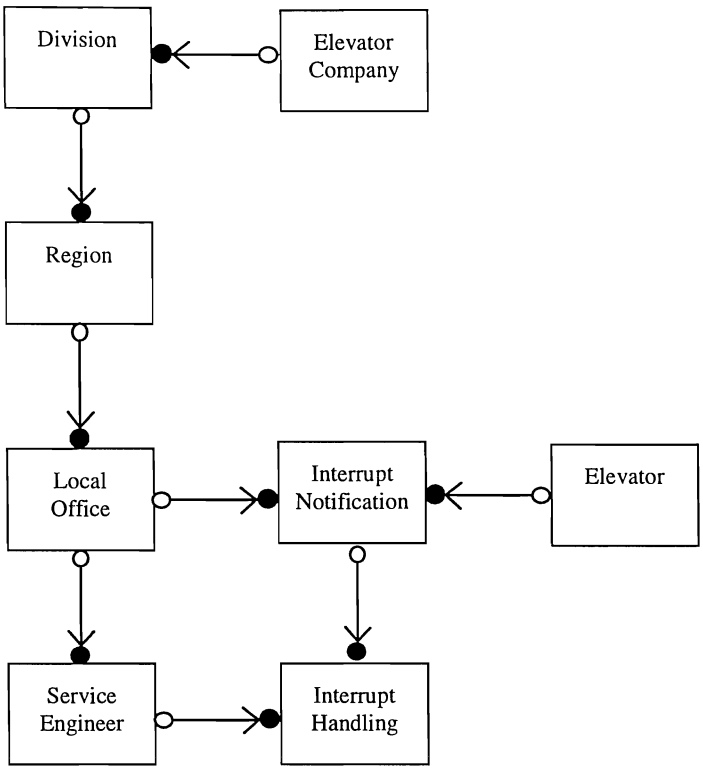

Fig. 6. An Elevator Company

Observe how the relationship between Interrupt Handling and Interrupt Notification avoids a direct relationship between Elevator and Interrupt Handling. Obviously, a critical inspection of the different organisational layers is needed. A more fundamental shift is a change of the role of the service engineers. Instead of making them dependent on the local offices, they could become independent service providers, suppliers which are working on a contract basis with the company. At the same time, all organisational layers can be removed. The result is the re-designed organisation for interrupt-handling in Fig. 7.

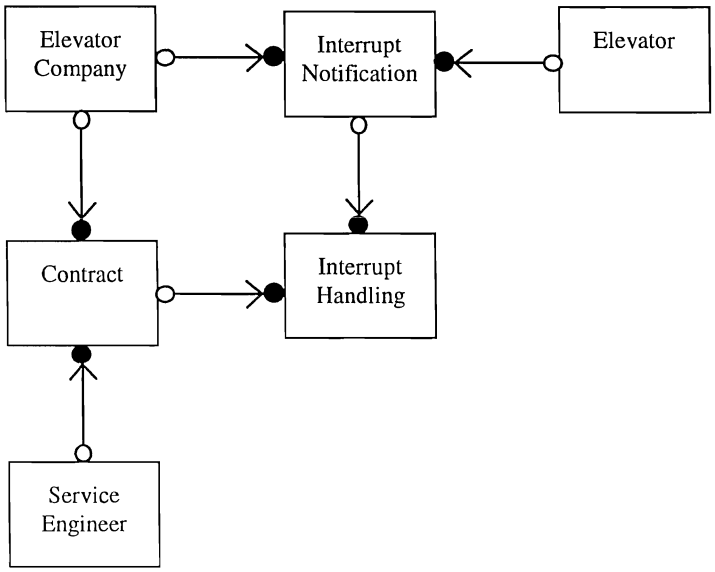

Fig. 7. Redesigned model for the Elevator Company

This model allows only Interrupt Handling that results from Interrupt Notifications. If the organisation also wants to include other Interrupt Handling (such as preventive actions), the direct dependency of Interrupt Handling on Interrupt Notification is replaced by an additional relationship with elevator. Both models can be combined in a single one, if a specialisation on Interrupt Handlings is used, as in Fig. 8.

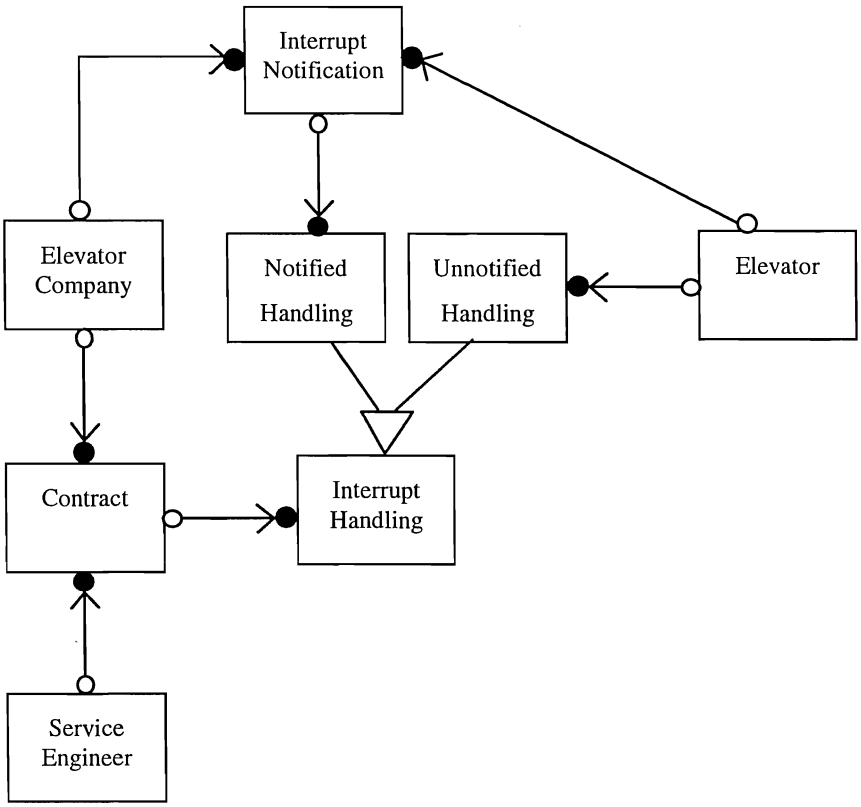

Fig. 8. Different types of interrupt handling

The re-designed business model satisfies the criteria that are typically used to evaluate business process re-engineering [3, 4]:

1) The new organisation is simpler, what should lead to a cost reduction.
2) The new organisation allows faster turnaround times for the key business activities.
3) The new organisation is more flexible.

Analogous examples can be developed for other business types, like the relationship between a Insurance Company and its Agents, for claim handling in the context of policies.

FURTHER MODEL EXTENSIONS BY USING "TYPE" BUSINESS OBJECTS

Further flexibility can be induced in the models by means of the introduction of "type" objects. The models presented so far consider only one type of transaction intention or effective transaction. In reality, multiple kinds of transactions will interleave in business organisations. Fig. 9 is a model that considers multiple transaction types in a market organisation with a product function.

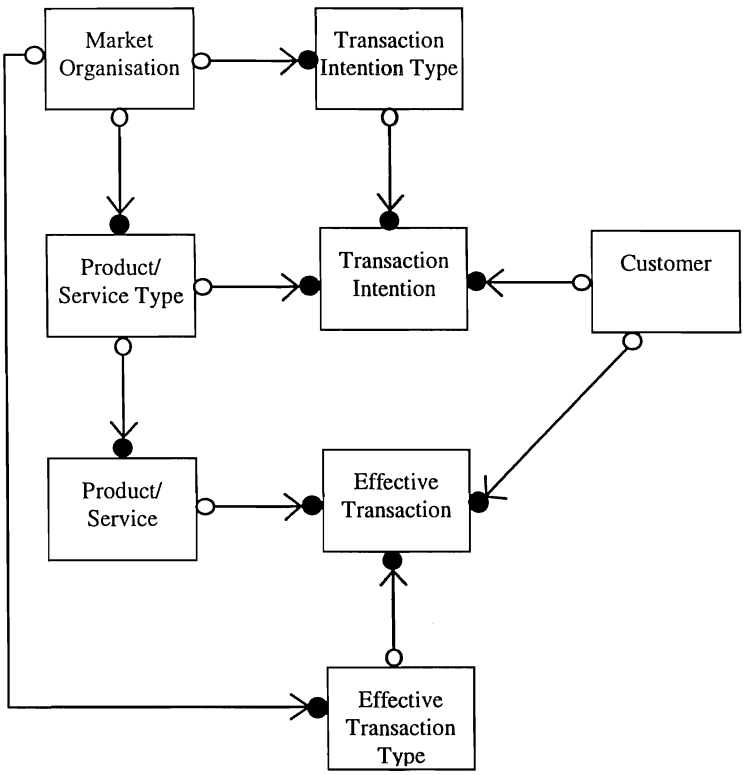

Fig. 9. Allowing for multiple types of transactions

The use of "type" business objects can be illustrated by instantiation of the above model into the claim handling business area of an Insurance Company as in Fig. 10.

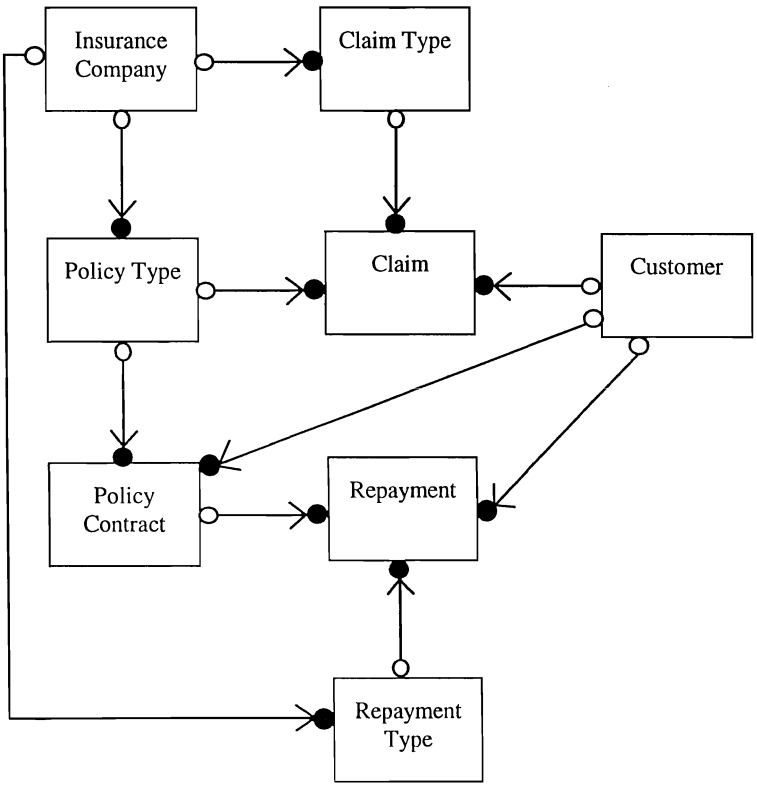

Fig. 10. Insurance company model

Claim types refer to the possible damages included in a policy like fire, theft, water damage and so on. The use of typing objects makes it easier to instantiate the model to a particular business situation and avoids extensions to the model.

III: A Task Organisation with a Product Function

The primary difference between a market organisation and a task organisation is the presence of a controlling organisation which regulates basically the relationship between customers and economic organisations. The controlling organisation may be a government, or a certifying organisation. On a macro scale, the difference between a market organisation and a task organisation is the difference between a locally driven, free economic system and a centrally directed plan-based economic system.

In a task organisation with a product function, the point of control in the hierarchy is at the product/service type business object. Indeed, control of that object implies control of all other business objects that are existence dependent on it, in particular the transaction intention, the concrete products/services and the effective transactions. A first generic model for such an organisation is depicted in Fig. 11.

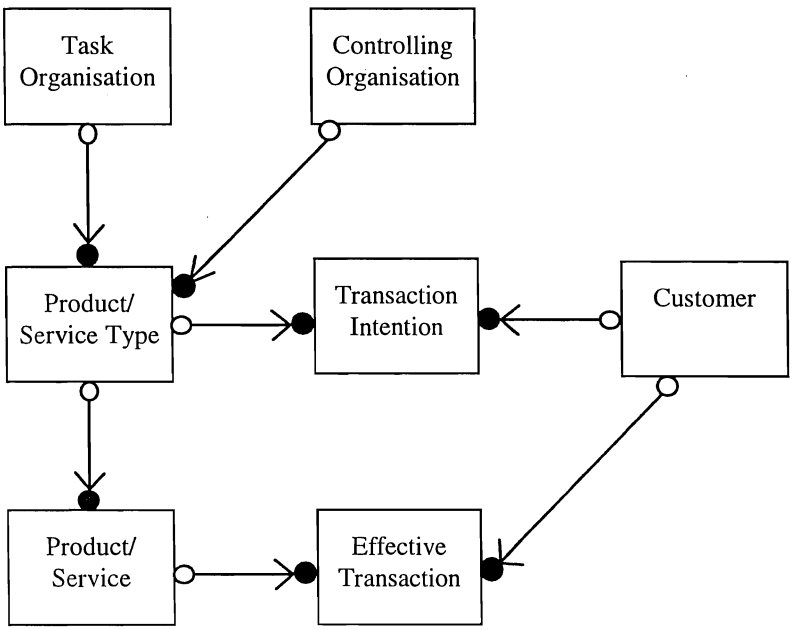

Fig. 11. Task Organisation with Product Function

A weaker form of control may exist when control only applies to transaction intentions and effective transactions. Such an organisation is free to determine its own product/service types. A modified model for this type of task organisation is shown in Fig. 12.

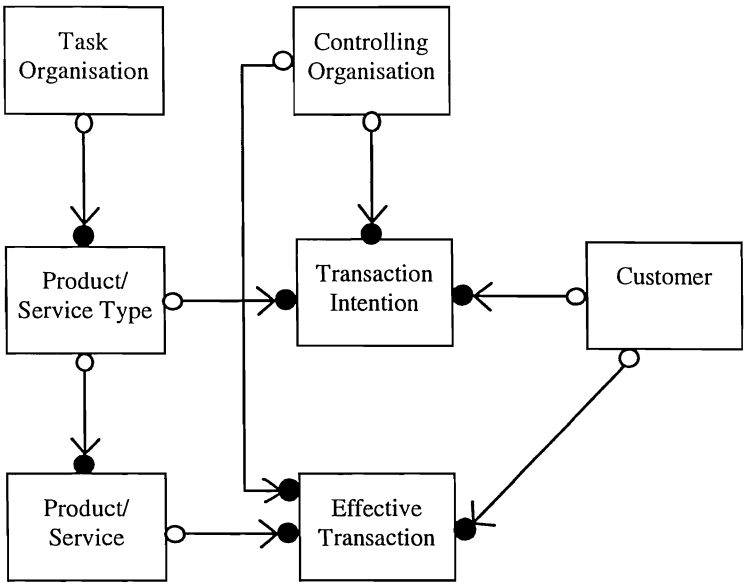

Fig. 12. Task Organisation with a weaker form of control

In the case of the hotel model, the controlling organisation can be a hotel chain, which supervises all of the operations within its chain. This can lead to a control on the types of products/services (such as a uniform definition of room types across the hotel chain) or a control at the level of the reservations and room rentals. A hotel in a hotel chain is no longer a market organisation, but a task organisation.

IV: A Task Organisation with a Capacity Function

A task organisation with a capacity function requires a controlling organisation that controls the channel. In this case, this implies direct control of the transaction intentions and the effective transaction. Fig. 13 shows a generic model for this type of organisation.

The controlling organisation should not be confused with an auditing organisation, which just needs information traces of business events, after the facts. In the above diagrams the controlling organisation fully participates in the creation of and the changes to the transaction intentions and the effective transactions.

A travel agent that operates in the context of a travel organisation is actually a task organisation, whereby the travel organisation acts as the controlling organisation.

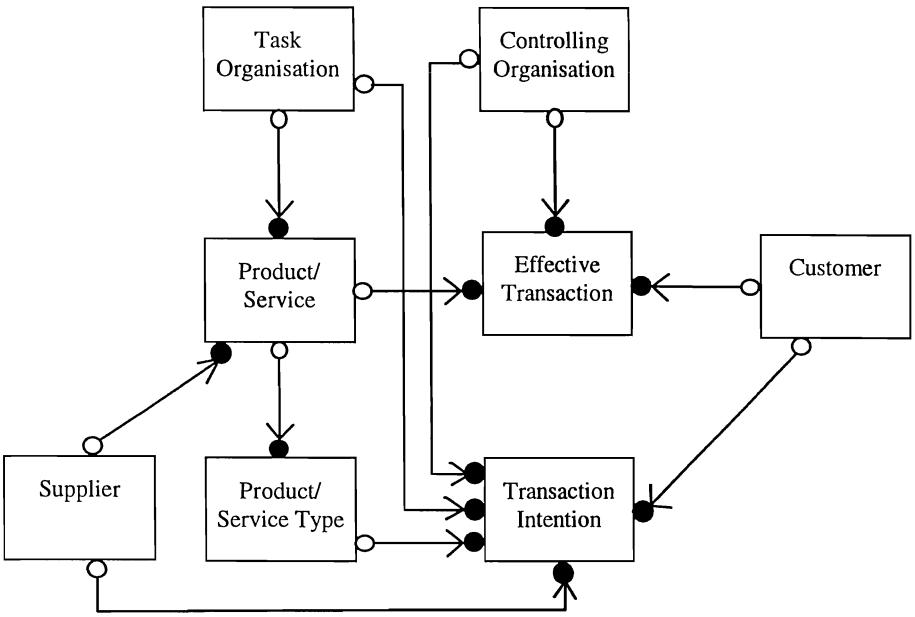

Fig. 13. Task Organisation with Capacity Function

GENERIC BUSINESS MODELS AND BUSINESS TRANSFORMATION

Three types of business transformations are generally available in literature [3]:

Type 1 : Process improvements in view of cost reduction
Type 2: Achieve to be "Best-in-Class", the most effective one
Type 3: Provide a breakpoint and rewrite the rules

Type 1 kind of business process redesign should focus on the reduction of the overall complexity of the business processes. In terms of an object-relationship model, this can be done by eliminating the unnecessary chains of existence dependencies, as shown in Fig. 14.

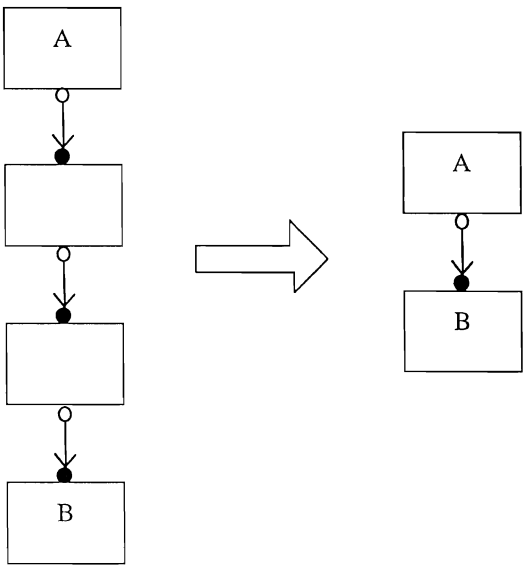

Fig. 14. Eliminating unnecessary levels

This type of transformation eliminates pure bureaucratic organisation types from business models. Another transformation is the elimination of unnecessary relationships between object types, especially if these relationships need to be cross-checked afterwards. This kind of simplification is also easy to represent in terms of an object-relationship model (Fig. 15).

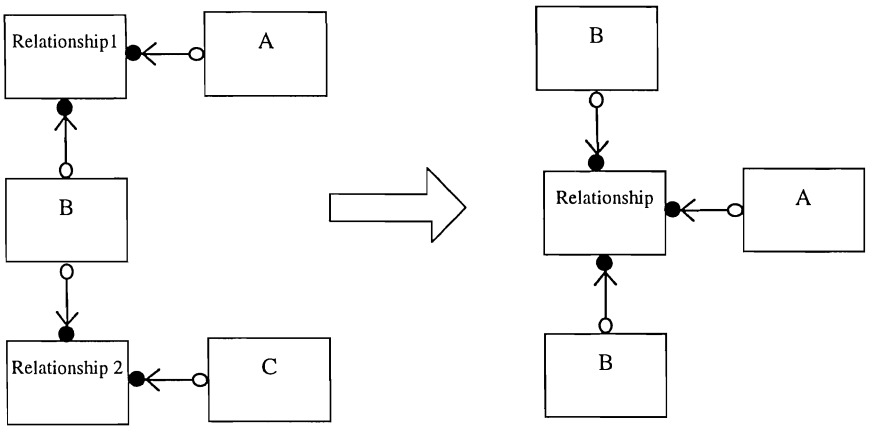

Fig. 15. Elimination of unnecessary relationships

Type 2 kind of transformations focuses on effectiveness rather than on efficiency. Within the rules of the market, whose standards may have been set in the past, a competitive leadership is targeted. This kind of transformation is performed by means of the introduction of additional control elements, in order to achieve economies of scope. In terms of the associated object relationship model, this transformations may lead to additional complexity and reduced dynamics in the organisation, if not properly monitored. More concretely, type 2 transformations are achieved by the introduction of a controlling organisation on simplified processes. In terms of the Simon typology, it involves a balancing between being a task and/or market organisation.

Type 3 kind of transformations change dramatically the business functioning and its rules. In terms of the typology of Simon, this kind of transformation involves a balancing between having a product function or a capacity function. In some cases, this is combined with a change of control. When a government controlled organisation has to become self-sufficient, it shifts from being a task organisation towards a market organisation. Moreover, in having traditionally a product function, it may well move into a capacity function, scanning the market for the best providers of the governmental product/service types.

DISCUSSION

Explaining the anticipated effects of business re-engineering to the involved business executives is far from easy. Most business re-design tools and techniques are very informal in nature. The advantage of the object relationship representation lays in the fact that it represents unambiguously the topology of the business objects. It shows their mutual dependencies and the precise agreements between them. New generations of professionals have even reduced barriers against object relationship modelling due to the wide-spread use of set theory in contemporary mathematics.

Generic business models provide help in avoiding continuous re-invention of the same solutions for the same problems everywhere around. With the help of generic models, business professionals can concentrate on their

creativity, the critical information about their business operations, the possibilities for business interlinking, better positioning, and so on. Once the actual business model is defined, it serves as starting point for the development of information systems[2]. This paper developed classes of generic object-relationship models, starting from the strategic function typology of Simon. The use of typing business objects enabled additional flexibility in the models.

Additional benefits are possible by the support of many CASE-tools for object relationship modelling. Rather than serving as a conceptual data modelling tool, a CASE-tool becomes an intelligent business modelling tool. This will impose additional requirements on CASE-tools, such as improved support for manipulation and navigation in large scale models [8]. A better understanding of the complexity of business models can lead to next generation tools that assist business professionals in simplification and rationalisation of business processes. It was the aim of this paper to contribute to this type of developments.

REFERENCES

1. Dedene G., Snoeck M., "Object-Oriented Systems from conception to delivery", Proceedings of Object Technology 94, the British Computer Society, Oxford 1994.
2. Dedene Guido, Snoeck Monique, M.E.R.O.DE.: A Model-driven Entity-Relationship Object-oriented DEvelopment method, ACM SIGSOFT Software Engineering Notes, Vol. 13, No. 3 (1994) 51-61.
3. Johansson H.J., Mc Hugh P., Pendlebury A.J. & Wheeler A.W., "Business Process Reengineering", John Wiley & Sons, 1993.
4. Maes R., "The Infrastructure-based Organisation", CEITO Research Report, University of Amsterdam, 1994.
5. Put F., "Introducing dynamic and temporal aspects in a conceptual database schema", Doctoral Thesis, Faculty of Economics and Applied Economics, K.U.Leuven 1988.
6. Simon M., "De Strategische Functie Typologie : Functioneel denkraam voor management", Kluwer Bedrijfswetenschappen, 1990 (in Dutch).
7. M. Snoeck, G. Dedene, Existence Dependency: Conceptual Modelling by Contract, Working Paper, Katholieke Universiteit Leuven, Dept. of Applied Economic Sciences; Submitted for Publication to IEEE TSE.
8. Teorey T.J., Wei G., Bolton D.L. & Koenig J.A., "ER Model Clustering as an Aid for User Communication and Documentation in Database Design", Communications of the A.C.M., 32(8), 1989.